Characterizing Stellar Variability for an Age Sequence of Open Clusters

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In our September 2013 Kepler 2 White Paper (arXiv1310.0772G), we proposed to observe with Kepler 2 stars in an age sequence of nearby open clusters. The initial Kepler field contained very few (only 4) distant and/or old clusters. The stellar content and cluster properties of nearby open clusters has already been well characterized from ground-based and some space-based multicolour photometric and spectroscopic observations. Here we propose to discover and characterize stellar variability in about 2700 probable cluster members of the four nearby open clusters accessible in Kepler 2 Fields 4 and 5: The Pleiades and Hyades (Field 4) and Praesepe and M67 (Field 5). Our primary goal is discover and refine the pulsation properties of mid and upper main-sequence variables (gamma Doradus, delta Scuti, and slowly pulsating B stars) having periods of hours to days accessible by long-cadence observations. Asteroseismology for these objects to date is limited by the number of modes observable from the ground and 1 c/d aliasing problems, difficulty in obtaining spectroscopic or photometric mode ID for the fainter variables that have been discovered/observed by Kepler, uncertainties in interior and initial abundances, especially for stars with abundance anomalies, uncertainties in distance/luminosity, and lack of knowledge of prior evolution history. We also target blue stragglers, A-F type stars with peculiar abundances that may or may not show pulsations, stars on the lower main sequence that may show variability due to rotating star spots or magnetic activity, binaries that may have one or more pulsating components. The constraints of common age, distance and initial abundances in clusters will place these stars in their evolutionary context, and help unlock some of the science questions and reduce uncertainties for understanding star formation and stellar evolution.